agricultural research

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Deadline 1990

1990 is the year Secretary Bergland has set. The goal is net energy self-sufficiency for agricultural production and for forest production and processing. And this is to be accomplished under conditions that sustain productivity. This all means, by the year 1990, American agriculture will be producing as much energy as it consumes. And that means achieving an important milestone toward the national goal of energy independence.

Behind this goal is an energy program equal to its task. The overall plan encompasses three major areas: energy conservation; substitution of renewable energy forms for scarce fossil fuels; and reducing the sometimes harmful effects of energy production and use.

At the heart of the program is an effort to develop viable, economic systems by which farmers and ranchers can produce energy from alternate, renewable sources. Through these, they can replace the fossil fuels on which American agriculture has come to depend so heavily. Among the sources, solar energy is the most promising.

Solar energy is a broad term. It includes heat captured by solar panels; power from the wind; and fuels and petrochemical substitutes from biomass; also, electricity from photovoltaic cells. Among these, biomass currently holds the most promise for American agriculture.

Biomass includes plant matter—grain, and field residues, cottonseed hulls, and byproducts from fruit and wood processing operations—as well as poultry and livestock manure. Through anerobic digestion, manure and other organic waste are fermented to produce methane gas. This fuel can not easily be condensed and stored, but it is fine for heating homes, poultry and livestock houses, and for drying grain; and it is a good fuel for stationary engines.

Now, SEA is expanding an already broad program to conduct research, extension, and education programs in this and similar areas. A part of this effort, in fiscal year 1980, will be two new regional solar energy centers. They will emphasize on-farm generation and use of energy, alcohols and biomass feedstocks, and other solar and wind applications. And the new technology is brought to those who need it through the cooperative extension system, with offices in more than 3,000 counties.

If American agriculture were net energy self-sufficient, the entire country would be more independent, and better able to apportion its own energy resources. This is precisely the goal. The deadline is 1990.—Robert W. Deimel

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COVER: Mastitis research being done by Max Paape and other SEA scientists could save dairy producers approximately 1 billion dollars each year (0779W938–24).

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Bob S. Bergland, Secretary
U.S. Department of Agriculture

Anson R. Bertrand, Director of Science and Education

Talcott W. Edminster, Deputy Director for Agricultural Research

New Loop in Mastitis Prevention

Anne Dulin, microbiologist, places the loop in the catheter for insertion into the mammary gland (0779W939–29).

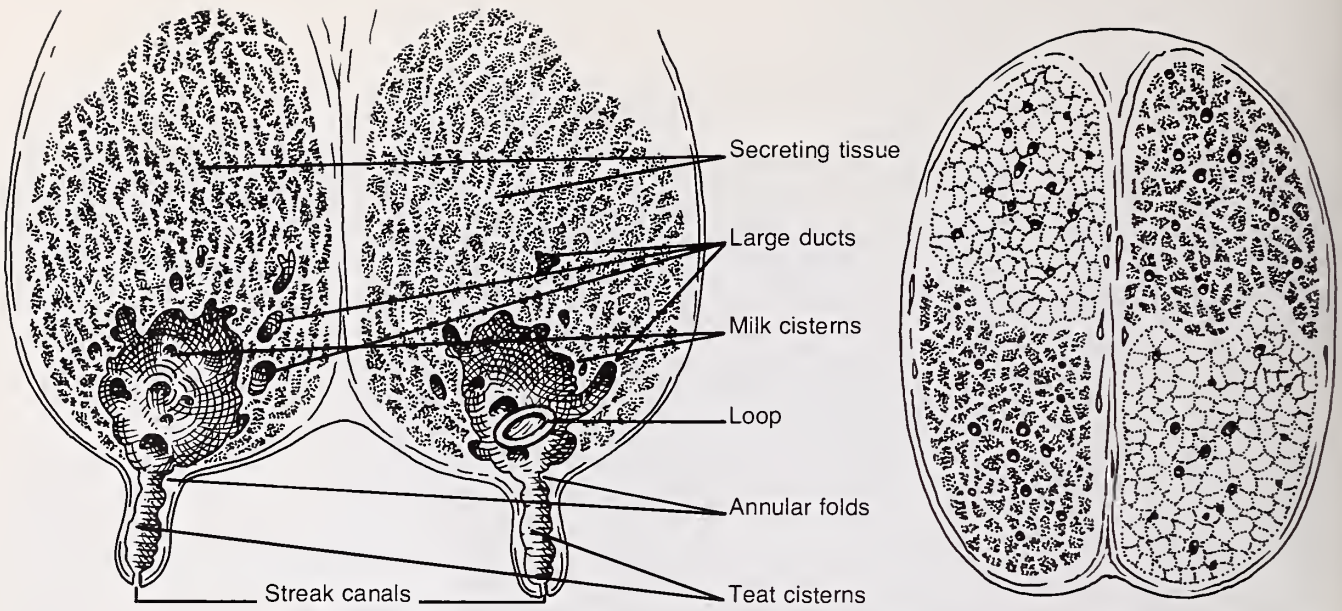
A small plastic loop inserted into each teat of a cow's udder may prevent mastitis, says Max Paape, a SEA animal scientist. At a rate to producers of approximately $1 billion per year, mastitis is the most costly disease in dairy cattle.

William Kortum, California veterinarian, developed the loops. Kortum also developed a polyethylene IUD for the bovine uterus.

The loops are made from a polyethylene similar to that used to manufacture plastic milk containers. A 4½ inch piece of the polyethylene is inserted into the teat through a catheter. Once inside the teat, the polyethylene resumes the shape of the loop.

The loop works by stimulating the animal's natural disease-fighting mechanism. The loop causes a mild irritation and in response the number of leucocytes in the affected area increases. Leucocytes, or white blood cells, destroy the bacteria that causes mastitis.

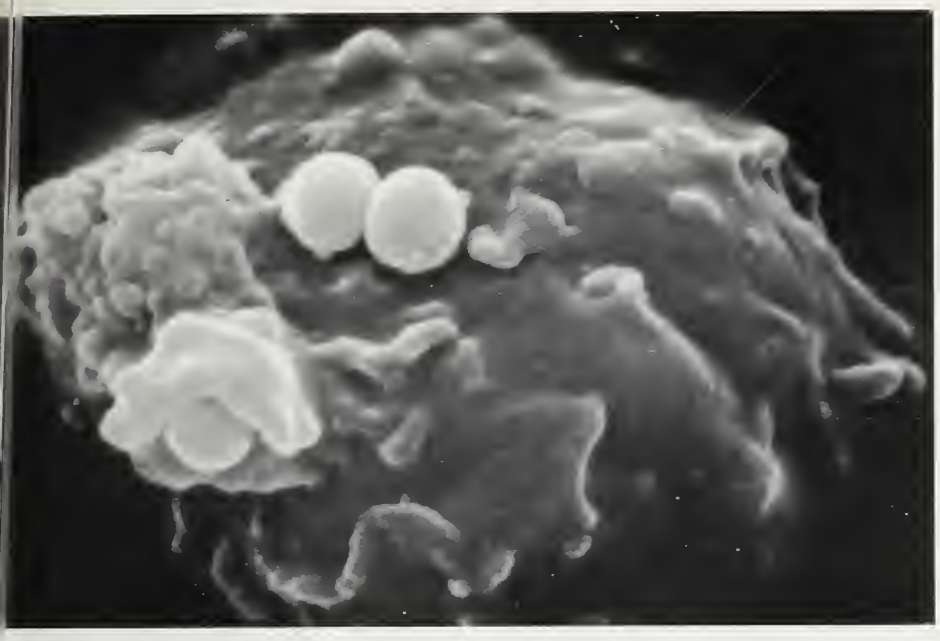
Normally, it takes about 24 hours for the leucocytes to build up to a point where they can destroy the invading bacteria. By this time, the bacteria have multiplied to such an extent that the infection may already have become established. Having the leucocytes already



Above: This diagram, illustrating a vertical (left) and horizontal (right) view of an udder, shows the loop position in the mammary gland (PN–4195).

Above Right: Leucocytes, white blood cells, are stimulated by the loop and attracted into the mammary gland, where they attack and destroy Staphylococcus aureus, the mastitis-causing bacteria (PN–4191).

Right: Once inside the mammary gland, the loop prevents mastitis without affecting milk yield, solids-not-fat, percent protein, or percent of fat in the milk (PN–4192).



present, in response to the loop, can prevent this buildup. Also, the loop "programs" the udder to respond faster in the case of infection.

In tests at the Beltsville Agricultural Research Center, Paape inserted the plastic loops into two quarters of the udders of six cows. (The loops have remained in place for over 1 year.) All quarters were then infused with toxins produced by *Escherichia coli*. E. *coli* cause a large number of mastitis infections. The teats with loops responded faster to the toxin and the leucocyte count rapidly increased in these quarters.

There were four times as many leucocytes in teats containing the loops as there were in teats without the loops. The number of leucocytes in the teats containing the loops should be sufficient to prevent the mastitis bacteria from becoming established. Tests, in which bacteria are infused into the teats, are now being conducted.

Further studies showed that the loop did not affect milk yield, solids-not-fat, percent protein, or percent of fat in the milk. The loop had no apparent effect on the overall milk leucocyte count. The increase in leucocytes was evident only in the first 20 milliliters of milk. This is normally stripped off before milking.

Large-scale tests under dairy farm conditions are being conducted in California by Kortum, in cooperation with Veterinary Extension, University of California, Davis.

Paape is continuing his mastitis research in France for a year conducting tests on dairy cattle. He plans to use loops in two teats of each of 20 cows.

These cows will then be infused with mastitis-causing bacteria and the results studied. These tests are needed before these loops can be recommended for mastitis prevention and made available to dairy producers.

Dr. Paape's mailing address is Building 173, Room 103, BARC-East, Beltsville, MD 20705. (*By Mary Ellen Nicholas, SEA, Beltsville, Md.*)

(Photo courtesy Grant Heilman)

Basin Tillage

Basin tillage, the method of mechanically placing mounds of soil at intervals across the furrow, has both eliminated rainfall runoff and increased cotton yields for 3 consecutive years.

SEA agricultural engineer Elmer B. Hudspeth, Jr., says that rainfall collects in the basins formed by the mounds and thus has time to filter down into the soil. This infiltration is particularly important in semiarid regions where rainfall is usually of high intensity and short duration.

Hudspeth points out that 80 percent

Cotton Cul

Cotton growers may be solving one of their pest problems—weeds—with a practice that puts an additional burden on ridding fields of another pest—pink bollworm.

Historically, a majority of growers cultivated cotton two to four times early in the growing season to rid the fields of weeds. Since herbicides came into general use for weed control, however, cultivations normally stop after an irrigation furrow has been prepared. That's where the problem begins.

A pink bollworm larva—a pest causing multi-million dollar losses to cotton—feeds in a cotton boll on developing lint and seeds. When its biological clock says it's time for another phase in its life cycle, the larva cuts out of the boll, drops to the ground, burrows into the soil, and pupates. Pupation occurs from a one-quarter to a one-half inch beneath the surface and when the moth emerges it has little trouble in reaching the surface.

SEA entomologist Thomas J. Henne-

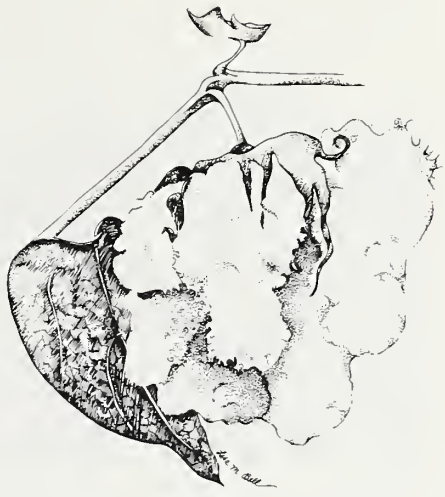
Increases Yields

of the annual rainfall at Lubbock, Tex., occurs during the cotton-growing season. Utilizing more of this rainfall can cut the cost of irrigation and conserve dwindling energy supplies.

A dramatic example of how water can be conserved was provided in July 1976, when almost 4 inches of rain fell during an 8-day period. After taking measurements, Hudspeth found that 3.2 inches of water were added to the soil of the basin-tilled field while only 1.1 inches were added to a conventionally tilled field.

This is an almost threefold increase and it makes a big difference: in 1975, there was an increase of 44 pounds of lint yield per acre on basin-tilled land; a 51-pound increase in 1976; and a 29-pound increase in 1977.

Dr. Hudspeth is located at the Cotton Research Laboratory, TAMU-Agricultural Research and Extension Center, Route 3, Lubbock, TX 79401. *(By Bennett Carriere, SEA, New Orleans, La.)*



vation

berry, Phoenix, has been filling in gaps of information regarding this behavior of pink bollworm larvae in soil.

He and Tommy Clayton, research technician, concluded from preliminary studies that using herbicides rather than cultivation may contribute to increased pink bollworm populations during the first half of the growing season.

Previous studies show that when a pupa is buried an inch or more in the soil, the emerging moth has trouble reaching the surface because of the additional soil, and dies in place.

Henneberry would like to see growers take advantage of that circumstance.

"Cultivation results in disturbance, redistribution and, to some degree, burial of pink bollworm larvae and pupae located on the soil and beneath the plant canopy," Henneberry says.

"Cultivation scatters some of the pink bollworms pupating in the soil and exposes them to potentially lethal soil surface temperature."

In laboratory studies, the researchers at the Western Cotton Research Laboratory, Phoenix, found that pink bollworm larvae buried in soil move upward reaching the soil surface or within about one-half inch of it before they pupate. Timing, then, is important in burying pupae.

Larvae released on the surface of the soil pupated, in most instances, within the same one-half inch depth in 48 to 72 hours.

However, burying the larvae about 3 inches in the soil 24 hours after the larvae had entered the soil resulted in 71 to 99 percent reduction in moth emergence.

Burying pink bollworm pupae under only about an inch of soil resulted in 95 percent or greater reduction in moth emergence.

The researchers are now attempting to duplicate the laboratory findings in field studies.

Henneberry said that growers cannot be expected to duplicate in the field what scientists can do in the laboratory. He thinks that cultivation will bury some of the pupae and expose larvae to the heat of the sun, a practice that could aid in reducing pink bollworm numbers.

"Early cultivations could be included in a package of practices—now called integrated pest management—that would substantially reduce pink bollworm damage. Some of these could include cotton varieties, nectariless cotton, steep narrow beds, early varieties, management for earliness, early planting, and crop rotation," Henneberry reports.

"Frequent cultivations also seal cracks in the soil and along with steep-sided beds, cause most larvae to slide into the furrow after cutting out of the boll. There, the high soil temperatures kill them."

Dr. Henneberry is stationed at the Western Cotton Research Laboratory, 4135 E. Broadway Road, Phoenix, AZ 85040. *(By Paul Dean, SEA, Oakland, Calif.)*

Agriculture: The China Connection

To paraphrase an old Chinese saying, visiting U.S. agricultural facilities in 4 weeks is like "riding a fast horse through a great garden to watch the flowers."

A team of seven animal health scientists from the People's Republic of China (PRC) recently made a historic first visit to the United States. The delegation visited facilities of USDA, several land-grant universities, and a sampling of industrial firms in nine states.

In November 1978, Secretary of Agriculture Bob Bergland and SEA Administrator Anson Bertrand visited the People's Republic of China. While there, they worked with the Chinese in developing agricultural scientific exchange programs between the two countries. This visit is a direct result of their efforts. Cochairmen of the U.S.-PRC Animal Sciences Exchange Program are SEA national program scientist Roger J. Gerrits, and Terry Greathouse, associate dean of agriculture, Texas A&M University.

The Chinese learned about U.S. animal health research and technology and, according to Cheng Shaojiong, their spokesman, they also learned much about the openness and friendliness of American people.

Vice president of the Chinese Academy of Agricultural Sciences and the head of the China Livestock Hygiene Investigative Group, Cheng is a 1922 graduate of the College of Veterinary Medicine at Iowa State University, Ames.

Cheng said he felt like Rip van Winkle after visiting the United States again after 50 years. He said the U.S. has achieved great advances in science and culture from what he remembers in the 1920's.

Cheng said there were very few U.S. scientists with doctoral degrees at research labs during the 1920's, but now between 60 and 70 percent have doctoral degrees.

The delegates said this helps to explain the rapid development of science and technology in the U.S., and the high quality of the many published research reports they collected to take home with them. They were also impressed with the sophisticated equipment viewed at each research location.

"Science is the pioneer of development." was another old Chinese saying the tour group quoted. Group members said this was true in the American industries they visited, where the research units are very important—some firms put as much as 10 percent of their gross income into research.

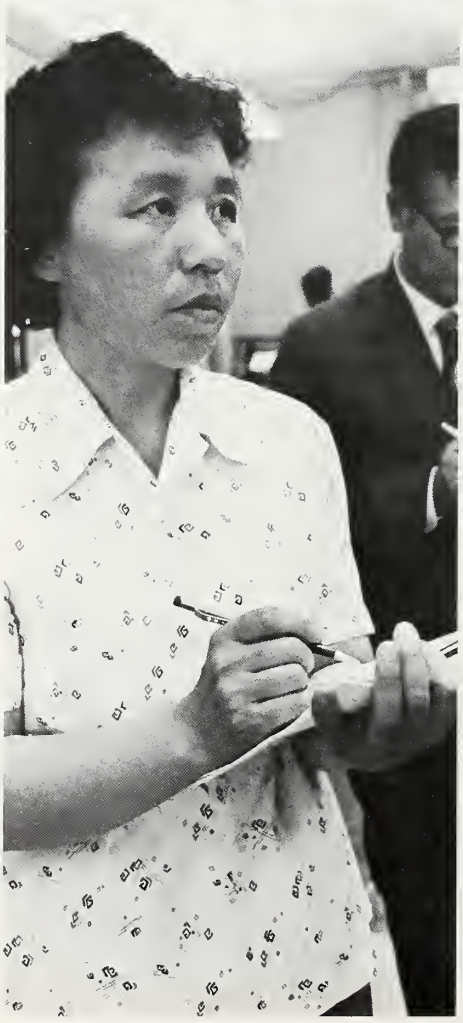
The tour group reviewed the specific-pathogen-free (SPF) program at the

Left Top: Sun Darong (left) and Xu Yuntian, leader of the PRC Germplasm Team, inspect tomato plants while on their tour of the Beltsville Agricultural Research Center (0879X1067–33).

Right Top: Paul Putnam, Beltsville's assistant director, welcomes the Chinese visitors to the Research Center (0879X1066–36A).

Right Bottom: Meg Campbell of USDA's Office of International Cooperation and Development discusses plant growth with Dong Yushen, a member of the PRC Germplasm Team (0879X1068–27A).

Left Bottom: Interpreter He Chunpei informs Cheng Shaojiong of aflatoxin research being conducted here at the Russell Research Centers Pharmacology Laboratory in Athens, Georgia. William C. Patterson, Jr., assistant area director, accompanied the group (0879X1090–10).



Top: Chinese scientists inspect the solar panels at Beltsville's solar-powered milking parlor (0879X1067–17).

Above: David Shen (hand raised) of USDA's Pioneering Research Laboratory in Pullman, Washington, accompanied the group on their tour. Here he explains a point to Cheng Shaojiong, leader of the PRC Animal Health Delegation and Vice President of The Chinese Academy of Agricultural Sciences (0879X1092–16).

Right: Feng Jinlan, a veterinary expert, was one of eighteen PRC scientists to visit the United States (0879X1094–24).

University of Nebraska, Lincoln, where they found "bright prospects to eliminate infectious diseases in swine." The SPF program is of great interest to China.

The PRC delegation said they had learned a great deal and felt they had promoted friendship between the scientists of their country and ours.

The delegation also received a glimpse of American culture by visiting in the homes of 12 company managers, farmers, and government officials.

Cheng said more teams from the PRC will come to study the details for which the first team dd not have time. He would like to see PRC scientists working here with American scientists, and programs for Chinese students to come and learn at the U.S. universities. The general idea of doing so was discussed at many stops along the group's route.

Also, as an outgrowth of this first visit, an exchange of information and animal health research results will likely take place. The PRC team members said they want to send their scientific journals to this nation, and said information on diseases and vaccines collected in the U.S. by the Animal and Plant Health Inspection Service (APHIS) is of vital interest in many countries of the world—including the PRC.

The group said their visits achieved for them and their country a "bumper harvest" of technology, as well as the start of a new Sino-American friendship—that, like a seed, will "root, blossom and fruit."

The department's Science and Education Administration hosted the visit, which ended July 27. A team of animal scientists and veterinarians from the United States will visit the PRC this fall.

A second PRC delegation, interested in plant germplasm research, also toured the United States during August. SEA national program scientist Quentin Jones and D. W. Barton, director of the New York state agricultural experiment station, are cochairmen of this program. *(By Stu Sutherland, SEA, Washington, D.C.)*

Breast Feeding Beneficial

Discovery of a component in human milk reveals an additional nutritional advantage to infants who are breast fed. The discovery also sheds light on a rare inherited disease, and it may lead to improving understanding of trace mineral absorption in human nutrition.

Biochemist Gary W. Evans and coworkers have identified the component as pyridine-2-carboxylic acid, also known as picolinic acid, in studies at the SEA Human Nutrition Laboratory, Grand Forks, N. Dak.

Evans says breast-fed babies may consume no more zinc than other babies. But picolinic acid in human milk may help the breast-fed infants' intestines absorb zinc more efficiently.

The discovery may help medical science in its study of acrodermatitis enteropathica (AE), a rare inherited disease that is sometimes fatal to infants if it is not diagnosed and treated in time. The disease impedes zinc absorption.

Its symptoms are characteristic of zinc deficiency—diarrhea, rash, and loss of hair.

Evans said that breast feeding long has been recognized as beneficial therapy for infants with AE. For children and bottle-fed babies with the genetic defect, doctors typically prescribe enough oral zinc sulfate to provide two or three times as much zinc as normally recommended daily allowances. Some AE patients, including adults, have been treated with drugs classified as halogenated quinoline derivatives.

The quinoline drugs chelate or bind zinc, somehow enhancing absorption of the trace mineral by the small intestine. Evans said picolinic acid, classified as a ligand, also binds zinc.

In the SEA Human Nutrition Center studies, Evans found picolinic acid in cow's milk as well as in human milk, but only about one-tenth as much is in cow's milk.

Humans and animals produce picolinic acid from the amino acid, tryptophan, through a series of biochemical reactions, Evans said. He hypothesized that babies with AE are incapable of producing as much of their own picolinic acid as babies without AE. This idea seems to strengthen insights of other researchers who have suspected that AE patients have an inherited defect in their ribunucleic acid (RNA) coding for the enzyme, kynurenine 3-oxygenase. The enzyme is involved in picolinic acid synthesis.

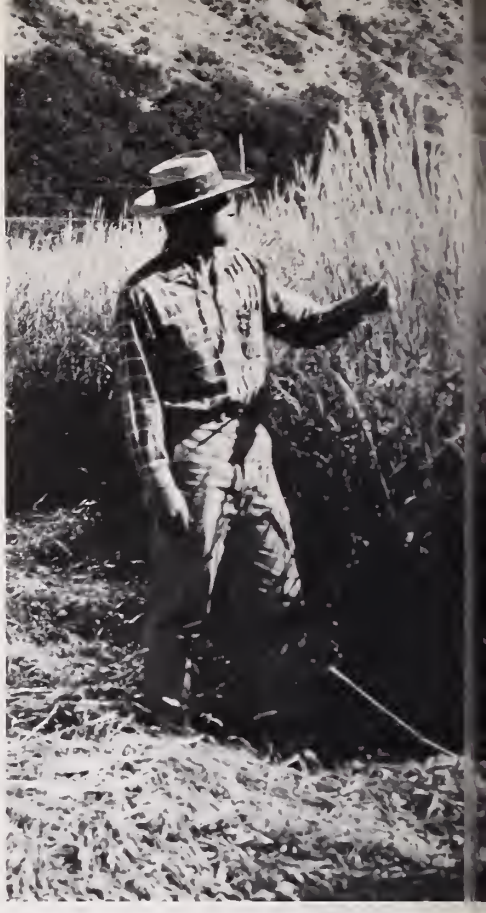
Procedures that the research team used to isolate and identify picolinic acid could be used in studies on zinc-binding ligands in other foods and biological fluids. Now, however, the scientists are concentrating their studies on cow's milk and human milk to learn whether other important metal absorption-aiding ligands are present, and the extent to which trace minerals other than zinc may be bound to them.

"Unless we gain a thorough understanding of the absorption processes and relationships among dietary components," Evans says, "attempts to supplement diets with trace minerals could sometimes be ineffective or possibly detrimental to health."

Dr. Evans' address is P.O. Box 7166, University Station, Grand Forks, N.D. 58201. *(By Ben Hardin, SEA, Peoria, Ill.)*

(0678A807-29)

Reed Canarygrass... Thrives on Sewage



"Reed canarygrass stands alone among eight forages tested as the species best suited for removing nitrogen from sewage effluent and for producing the most protein per acre," says SEA research agronomist Gordon C. Marten.

The 3 years of trials compared two rates of effluent application, 4-inches-per-week and 2-inches-per-week on alfalfa (Agate), smooth bromegrass (Fox), orchardgrass (Nordstern), Kentucky bluegrass (Park), tall fescue (Kentucky 31), timothy (Climax), reed canarygrass (Rise), and quackgrass.

Three harvesting patterns, two, three, and four cuttings per season, were evaluated. Marten, soil chemist Charles E. Clapp, and soil scientist William E. Larson, all stationed on the University of Minnesota campus, evaluated the forages for persistence, yield, crude protein, and digestible dry matter.

Root rot problems limited alfalfa on the effluent-treated plots, Marten said. Timothy and smooth bromegrass also failed to persist well enough to merit consideration under effluent applications.

Tall fescue and Kentucky bluegrass failed to persist well under high nitrogen applications when cut only twice per season, but persistence was excellent when they were cut four times per year.

The average yields of all eight species, after 3 years of tests, were 4.7 tons of dry matter per acre (10.5 metric tons per hectare) under the 4-inches-per-week effluent treatment, and 4.5 tons per acre (10 metric tons per hectare) from the conventionally treated plots receiving well water and commercial fertilizer.

"Our results indicate that effluent applications of at least 4 inches per week during the growing season in temperate regions can lead to maximum yields of forage dry matter and feed nutrients by persistent species," Marten said.

"Reed canarygrass always yielded the most crude protein, marking it as the best species for removing nitrogen from wastewater effluent," Marten added.

Under 4-inches-per-week effluent applications and three cuttings per season, 3-year averages were: reed canarygrass 5.3 tons of dry matter per acre (11.9 metric tons per hectare); tall fescue 4.9 (11.1 metric tons); and orchardgrass 4.5 (10.1 metric tons).

Under 2-inches-per-week effluent applications, tall fescue averaged 4.5 tons dry matter per acre (10 metric tons), reed canarygrass 4.4 (9.9 metric tons), and Kentucky bluegrass 3.3 (7.4 metric tons).

The test site was next to the source of effluent, the Apple Valley Wastewater Treatment Plant of the Twin Cities Metropolitan Waste Control Commission of Minneapolis-St. Paul. The effluent from the plant contained an average of 17 to 27 parts per million (ppm) of nitrogen and 4 to 12 ppm phosphorous. Applications were made from April through October.

The control treatment area was irrigated with well water whenever soil moisture stress occurred. Nitrogen and phosphorous were supplied to meet plant needs. Both the control and effluent treated plots received fertilizer potash in equal amounts, because the plants could not extract enough potash from effluent alone to meet their needs.

Dr. Marten is in the Agronomy Department, and Dr. Clapp and Dr. Larson are in the Soil Science Department at the University of Minnesota, St. Paul, MN 55108. *(By Ray Pierce, SEA, Peoria, Ill.)*

Sometimes

Under some environmental and plant growth conditions, cattle can thrive on reed canarygrass—one of the highest producing, most widely used forages for marshy areas. Under other conditions, cattle can die from it.

Nitrogen is taken up from the soil by reed canarygrass in the form of either nitrate or ammonium. Normally, both forms are converted to protein, but certain environmental conditions can cause excessive amounts of nitrate to accumulate in a plant and remain in the nitrate form. Cattle ingest this nitrate which is converted in their rumen to nitrite. Nitrite alters cattle red blood cells so that these cells can no longer carry oxygen, causing the animals to die. This is called nitrate poisoning and it can happen when nitrate levels in reed canarygrass exceed 0.21 percent.

SEA range scientist F. B. Gomm, Logan, Utah, studied the conditions that create this dangerous nitrate buildup and observed that the buildup is

(UT 1498)

a Threat

related to soil moisture content, light, and temperature.

The amount of nitrate available in the soil also influences the situation. However, reed canarygrass grown in saturated soil never accumulates much nitrate.

Light stimulates a chemical reaction within canarygrass that reduces nitrate. Nitrate levels in leaves and stems fully exposed to sunlight are lower than levels in leaves and stems shaded from the sun. High soil moisture content and cool temperatures further slow nitrate buildup.

According to Gomm, the probability of nitrate poisoning occurring early in the canarygrass growing season is small because soil moisture is usually high, lower plant stem and leaf shading is minimal, and temperatures are relatively cool. Later in the summer, nitrate accumulation increases because the soil is usually drier, the foliage of canarygrass plants is more dense (cutting the lower part of the plant off from sunlight), and day temperatures are warm.

Excessive nitrogen fertilization further aggravates the problem.

Not only does the mere presence of the fertilizer mean more nitrate available in the soil to the canarygrass, but the fertilizer also increases the density of the upper plant foliage.

Gomm says that ranchers should be aware of the potential problems with reed canarygrass and should exercise temperance in fertilizer applications. They might also plant a mixture of alfalfa or clover with the canarygrass to cut down on cattle consumption of canarygrass. Gomm warns that under drought conditions or late in the growing season, reed canarygrass—especially if heavily fertilized—can be dangerous or even lethal to cattle.

Dr. Gomm is located at Utah State University, Crops Research Laboratory, UMC 63, Logan, UT 84322. *(By Lynn Yarris, SEA, Oakland, Calif.)*

Faster Flowering

Plant physiologist Gary H. Heichel persuaded reed canarygrass, which normally takes nearly 2 years to produce seed, to come into flower in just 20 weeks. He did so by chilling 4-week old seedlings with 5°C (40°F) temperatures for 12 weeks in controlled environment chambers.

When planted in the fall, reed canarygrass grows through the next season and produces seed the following spring, taking about 20 months in the process.

"By speeding up the seed producing process, we have the potential to do 4 years' work, crossing, screening, and evaluating reed canarygrass crosses for improved forage quality, yields, and other factors in just 1 year," Heichel said.

There has been little research on techniques of forage grass vernalization, the speeding up of the normal reproduction periods of plants by holding them at cool temperatures to induce early flowering.

Heichel began the experiment by working out a program of chilling the seedlings in growth chambers for various periods and at various stages of growth.

After 10 months of tests, he achieved the best results with the 12-week chilling period starting when the plants were 4 weeks old.

University of Minnesota researchers Arne W. Hovin, plant breeder, and Keith I. Henjum, assistant scientist, worked closely with Heichel on the project.

Dr. Heichel's address is Room 404, Agronomy Building, University of Minnesota, St. Paul, MN 55108. *(By Ray Pierce, SEA, Peoria, Ill.)*

Goggles Light Insect Night Life

SEA entomologist Pete Lingren models a pair of the night vision goggles being used to observe night flying insects (PN–4193).

Use of night vision goggles in studying nocturnal behavior of insects has added a new dimension to insect research and control. Their use could aid in developing new control techniques or modify existing ones.

SEA entomologist Pete D. Lingren, Phoenix, Ariz., says "Our ability to properly assess insect control techniques for nocturnal species and use them efficiently depends on our knowledge of the nighttime activity of the adult. In other words: when, where, and why are adults active; what influences that activity; and to what extent can we interfere with that activity as an aid to pest management?"

"In the past, control measures for the tobacco budworm, for instance, have been aimed primarily at the larval stage, the stage that does most of the damage to crops. However, larvae are not mobile and it is the adult female that controls where the eggs and, thus, the larvae are placed. Elimination of one female could result in a loss of up to 1000 larvae. A concentration of knowledge of adult nocturnal behavior, bolstered by actual observations with the use of the night vision equipment, may lead to some means of reducing the impact of the species on crops," Lingren says.

The goggles, developed for the military and used for human nighttime surveillance operations and by the Forest Service in fire control, have added a tremendous tool to the study of night fliers. Other methods are also being used. Those include headlamps, mating tables (wings of virgin females are clipped to restrict movement and male response is observed), infrared photography, sex lure (pheromone) traps, and radar.

While the goggles have a built-in infrared source, the researchers at Phoenix have not been using it. They have supplemented the goggles with a spotlight fitted with an infrared filter. The light appears not to affect insects and scientists can observe them at will.

Information either developed or confirmed by use of the goggles includes:

- Adult tobacco budworms, which attack more than 35 domestic crops, begin feeding shortly after sundown and peak feeding ends about 2 hours later. In cotton, they generally feed on leaf and square nectaries—organs on the plant that secret nectar, other flowering plants, water droplets and aphid honey dew. These adults fly as high as a mile above the crop canopy as observed from ground level, TV towers, and radar.
- Oviposition — egg laying — coincides with feedings beginning shortly after sundown and continuing sporadically throughout the night.
- Mating seldom occurs before 3 hours after sundown and peaks about 7 hours later. Virgin females generally attract the first mates.
- Female pheromone—sex attract-

ant—does not trigger male searching. Male searching begins before release of pheromone. Males begin flying crosswind patterns to pick up female pheromone "plumes", then move upwind to the source. Plumes, from virgin females or synthetic pheromones, seem to disperse about 100 feet downwind, depending upon weather conditions.

- Late at night, females were observed placing pheromones in a triangular pattern on plants, apparently to increase the size of the plume and their chances of obtaining a mate.
- Males were observed rubbing their claspers on the glass mating tables and secreting an unknown substance. The substance will be analyzed to determine its role in mating behavior and whether it can be used in insect control.
- Population emergence, at least mid-season generations, seems to be closely related with the moon phase. Peak emergence and mating in the field occur about 4 days before the first full moon and 8–9 days before peak capture in pheromone traps.
- Observations at trap sites showed that virelure (synthetic pheromone of tobacco budworm) is highly attractive, but few males entered the traps. Of 6,772 attracted in one night, only 26 were captured. Of 2,477 insects attracted by virgin females, 215 were captured. Flight observations may lead to redesign of the traps.

SEA scientists cooperating in the study are Jimmy R. Raulston, Brownsville, Texas; Alton N. Sparks, Tifton, Ga.; Wayne W. Wolf, Phoenix, Ariz.; and Fred I. Proshold, St. Croix, Virgin Islands.

Dr. Lingren is at the Western Cotton Research Laboratory, 4135 E. Broadway Road, Phoenix, AZ 85040. (*By Paul Dean, SEA, Oakland, Calif.*)

AGRISEARCH NOTES

Bad With the Good

Few things are absolutely good or bad as evidenced by one SEA researcher. He has found that unless the soil drains well, using surface residue mulches to prevent wind and water erosion on dryland winter wheat-producing fields results in reduced wheat yields.

More and more dryland winter wheat producers are utilizing crop residue mulches to protect their soil from wind and water erosion. A byproduct of wheat production, residue mulches are practical to use and have proven to be effective means of erosion prevention. However, reduced wheat yields have been noted in some fields where residue mulches were used.

SEA soil scientist Ron W. Rickman, Pendleton, Ore., has traced these yield reductions to nitrogen deficiency. His tests show that slowly draining or poorly drained soils can develop anaerobic conditions leading to soil denitrification or the loss of nitrogen fertilizer. Surface mulches accentuate such conditions.

The situation is particularly bad on slowly draining soil during a wet winter. A heavy mulch allows too much water and not enough oxygen to enter the soil, but without mulch, the soil receives too little water.

Rickman's tests do show that when the soil is well-drained, there is no nitrogen lost or subsequent wheat yield reduction.

Dr. Rickman is located at the Columbia Plateau Conservation Research Center, P.O. Box 370, Pendleton, OR 97801. (*By Lynn Yarris, SEA, Oakland, Calif.*)

Eliminating the Spoil

"Isolate the acidic lignite 'spoil' from the surface rooting zone during reclamation operations following strip mining," says SEA soil scientist Frederick W. Chichester. Spoil, material adjacent to lignite seams which is left behind after strip mining, can kill plant life.

In a glasshouse study on the growth potential of warm season forage grasses, seedlings which emerged from spoil died within a few days due to acid conditions and a high salt content. After the spoil is removed, Chichester reports that adequate fertilizer and lime amendment of remaining overburden materials will provide suitable soil media for grass revegetation.

Fertilizer treatment combinations of nitrogen, phosphorus, and lime were applied to soils of different texture and acidity taken from drill cores from an undisturbed mining site in east central Texas. Plant response to nutrient treatments in the study was evident as early as 14 days after sowing.

"The addition of nitrogen and phosphorus generally made the difference of whether or not seedlings survived and grew to harvestable size on the low fertility soil material," said Chichester. Application of lime improved nutrient response where acidity was a problem.

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Dr. Chichester is with the SEA Grassland, Soil and Water Research Laboratory, P.O. Box 748, Temple, TX 76501. *(By Peggy Goodin, SEA, New Orleans, La.)*

No-Till Reduces Soil Losses

A study shows that no-till cultivation is a very good management practice for reducing nonpoint pollution from highly erodible loessial soils. The study was conducted in northern Mississippi on loessial soils which were wind deposited long ago and are highly erodible.

Nonpoint pollution is pollution that does not come from a readily identifiable specific source, such as a chemical plant or sewerage canal.

SEA soil scientist Leslie L. McDowell and agricultural engineer Keith C. McGregor say that during a 2-year study, soil losses from no-till soybeans, planted directly through the residues of the previous crop, were only 0.3 metric tons per hectare per year. This compares with 29 metric tons per hectare per year from soybeans planted in conventionally tilled land.

The scientists point out that even though there were more soluble nitrogen and phosphorus in the runoff, the total loss of nutrients was much less from no-till crops because of the dramatically reduced amount of soil lost as sediment.

According to McDowell, "The low erosion rates from no-till practices are significant because of the potential reduction in soil loss from the increasing acreages of soybeans being planted on marginal land."

McGregor adds that "with careful management, farmers can plant soybeans on sloping land, minimize time and labor, and maintain good crop yields without serious soil and plant nutrient losses. Where applicable, no-till is a means of reducing soil loss and plant nutrient loss, as well as greatly reducing sediment pollution in rivers, lakes, and streams."

Dr. McDowell and Keith McGregor are located at the USDA Sedimentation Laboratory, P.O. Box 1157, Oxford, MS 38655. *(By Bennett Carriere, SEA, New Orleans, La.)*

Brown Stem Rot Resistance

Soybean seed of a recently developed variety resistant to brown stem rot is being increased and will be available to growers by 1981, plant pathologist Hideo Tachibana says.

The variety, BSR 301, is specifically for use in fields where 75 percent or more of the plants have suffered BSR infection, he said.

The disease has been a serious problem in parts of Iowa. Tachibana, stationed at Ames, suggests that farmers in Iowa and adjacent states check their soybean fields closely to see if they have a BSR problem, so they will know whether or not BSR 301 will be helpful to them when it becomes available.

When tested in problem fields under severe disease conditions in southern Iowa, BSR 301 yielded 30 percent more than soybeans that were susceptible to BSR. Where BSR is not a problem, the new variety yielded a few bushels less than current high yielding beans in regional field test yield averages.

Tachibana refers to BSR 301 as a "prescribed resistant variety" because it can be prescribed for specific disease problem fields.

Dr. Hideo Tachibana's address is Department of Botany and Plant Pathology, Iowa State University, IA 50011. *(By Ray Pierce, SEA, Peoria, Ill.)*

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